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Evolution of urban structures in Romania and some EU countries

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Abstract

Urban structure consists of all the relationships established in urban areas, between its components: functional, psychosocial, physical and spatial. Developments depend on demographic concentration and socio-economic and cultural differentiated development of member localities. Analysis presented in this material follows changes recorded in urban structure from several European countries for a time period of approximately 30 years. The same analysis was conducted for Romania, highlighting the phenomenon of concentration of urban structure or reducing the concentration, by decreasing share of cities and increasing importance of small and medium towns. After 1990, Romania displayed a phenomenon of emergence of new towns that have led to changes in urban structure.

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Keywords: urban structure; indicators; urban system

1. Introduction

Urban structure consists of all the relationships established between elements urban system: functional, psychosocial, physical and spatial, materialized in various forms of manifestation and related to the environment, by integrating the functional structure with the spatial structure (Antonescu, 2007). Development of contemporary urban systems is a consequence of population concentration and socio-economic and cultural differentiated development. The increasingly obvious change of relationships between cities, amid space

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contraction and globalization, stimulates urban systems dynamic (Tălângă, 2010). In specific research, an increasingly important place is taken by analysis on discontinuity and fragmentation of urban areas. Urban structures evolve over time either to a higher concentration (small towns lose their importance and population is concentrated in large urban areas) or to a lower concentration (people leaving the cities to small and medium towns). It is possible to maintain a constant urban structure (rev.Urbanismul, 2010).

This paper aims to analyze the evolution of urban structure for a period ranging between 20 and 30 years, depending on the availability of data. The analysis was carried out on a sample of cities in several European countries: Poland, Belarus, Greece, Sweden, Hungary, Bulgaria.

2. Analysis of urban structure in some European countries

Analysis of urban structures in several European countries was conducted on the premises described below (see Table 1):

- There have been considered a sample of cities from several European countries (Poland, Greece, Sweden, Hungary, Bulgaria); analysis will follow cities with population larger than 10,000 people;
- Periods considered in the study are those provided by the available data source;
- City grouping was made on 14, 15 and 16 size groups;
- For comparability of urban concentration index, concentration standardized indicator was calculated for range 0-1.

Table 1: Countries, groups of cities and years of analysis

Countries	Groups of cities	Base year	Current year	Period (years)
Bulgaria	15	1980	2012	32
Greece	15	1991	2011	20
Hungary	14	1980	2012	32
Sweden	16	1990	2012	32
Poland	15	1980	2012	32
Romania	25	1978	2011	34

According to available data, we conducted clustering for Hungarian cities in 14 groups, 15 groups in Bulgaria, Greece and Poland, 16 groups for Sweden and 25 groups for Romania. The base year to perform the analysis is 1978 for Romania, 1980 for Bulgaria, Hungary and Poland, 1990 for Sweden and 1991 for Greece. Data used in study are from 2011 for Romania and Greece and from 2012 for Bulgaria, Hungary, Sweden and Poland (Innovation Cities Europe Index, 2014).

Table 2 shows some characteristics of urban structures in the analyzed period and of average population for the same period, according to data available.

Table 2: Characteristics of analyzed urban systems

Countries	Medium base town (thds)	Medium current town (thds)	*Medium town dynamic*	Urban population in base year (thds)	Urban population in current year (thds)	Urban population increase (no.)	*Urban population dynamic*
Bulgaria	92.98	87.34	*93.9%*	4.462.98	4.192.53	-270.45	*-6.06%*
Greece	93,56	101,16	*108,1%*	6.174,97	6.676,60	501,62	*8,12%*
Hungary	77,36	70,87	*91,6%*	5.337,53	4.889,98	-447,56	*-8,39%*
Sweden	39,88	45,96	*115,2%*	4.905,72	5.653,38	747,66	*15,24%*
Poland	74.13	79.41	*107,1%*	17.346,00	18.583.07	1.237.07	*7,13%*
Romania	41,52	36,65	*88,3%*	9.757,93	11.727,15	1.969,23	*20,18%*

It can be seen that the average town size decreased in Bulgaria, Hungary and Romania and grew up in other countries. Romania recorded the largest decrease in medium town size (11.7%) and Sweden the highest growth (15,2%).

It can also be ascertain a reduction phenomenon of urban population in Bulgaria and Hungary. In all other countries are recorded increases in urban population. The largest increase was recorded in Romania (20,18%) (INS Romania, 2014).

Urban structure analysis aims to identify trends in concentration / deconcentration using the structure index (IS). This index was calculated using the bellow stated formula:

$$p^* = \sqrt{\sum_{i=1}^{n} p_i^2}$$

where: p_i = percentage (structure)
p^* = structure index (IS)

IS can take a maximum value 1, when the entire structure is concentrated in a single element and a minimum of $1/N^{0,5}$, when all the structural elements are equally distributed among the N elements of the structure. IS minimum is different from an urban system to another, depending on the way of grouping component towns, while maximum IS can only have a value of 1.

Therefore the field of p* will be:

$$\frac{1}{\sqrt{N}} \le p^* \le 1$$

where: N = number of structural elements.

IS is the concentration degree or dispersion of a structure.

$$IS_n = \frac{p^* - p_{\min}}{p_{\max} - p_{\min}}$$

where IS_n = standardized structure index

$$p_{\min} = \frac{1}{\sqrt{N}}$$

$$p_{\max} = 1$$

For a better use of the range, is used the radical of the value IS_n :

$$IS_n^* = \sqrt{IS_n}$$

Table 3 shows urban concentration indicators for the analyzed countries, in the period under consideration in conducting the study. It can be observed a difference between Romania and the other analyzed countries, difference especially obvious for the minimum degree of concentration (minimum IS), which is 20% for Romania, while all other countries have a minimum degree of concentration over 25%.

Table 3: Urban Concentration Indicators

Countries	Town groups	Minimum Concentration degree (IS minim)	Maximum Concentration degree (IS maxim)	Concentration degree		Normalized concentration degree (IS) in 0-1 gap	
				Base year	*Current year*	*Base year*	*Current year*
Bulgaria	15	25,82%	100%	34,37%	37,14%	33,95%	39,06%
Greece	15	25,82%	100%	54,00%	50,50%	61,64%	57,68%
Hungary	14	26,73%	100%	47,38%	41,11%	53,09%	44,30%
Sweden	16	25,00%	100%	34,23%	34,36%	35,08%	35,33%
Poland	15	25,82%	100%	34,05%	35,22%	33,31%	35,60%
Romania†	25	20,0%	100%	27,63%	26,80%	30,89%	29,16%

It can be seen, from the analysis of structural indicators in Table 3, that the concentration degree (standardized) increased slightly in Bulgaria and Poland - which record percentages ranging around 35% - and declined in Greece, Hungary and Romania. It should be noted the high degree of urban concentration in Greece, ranging around 60%. The exception in this analysis is represented by Sweden, whose degree of urban concentration is constant, 35%, which indicates high inertia in time and stability of urban structure (SC Sweden, 2014).

Countries with the most concentrated urban structures are Greece (57.68% in current year) and Hungary (44.3% in current year). Greece has a population of 11.3 million inhabitants and nearly 4 million people (35.4%) are registered in just two cities (Athens and Thessaloniki). The Hungarian capital, Budapest, concentrates a population of 1.7 million people, representing 17% of the total population (10 million inhabitants in 2010) (OCUS Hungary, 2014).

3. Analysis of urban structure in Romania

The national system of settlement has suffered, especially in the twentieth century, a series of fluctuations related to changes in the number of urban settlements, population growth of towns due to massive industrialization policy, changes in the economic base of the settlements, through preferential orientation of investments to certain areas (Ianoş, 2004). All of these have left their mark on the development of urban structure in Romania, maintaining however a certain constancy, generated by self resilience of urban system (Antonescu, Popa, 2012).

As can be seen in Table 4, the number of towns increased in Romania, from 235 in 1978 to 320 in 2011. This has led to a decrease in the average size of towns at national level, as the number of towns increase was due to transformation of rural settlements in towns, therefore the number of small towns increased.

† In the case of Romania were available data on all cities while for the other countries were available only samples specified in the methodology.

Table 4: Evolution of urban structure in Romania

	1978	2011	Dynamics 2011/1978
Total population	9757.926	11727.153	1.20
No. Towns	235	320	1,36
Average/town (thds. loc.)	41,52	36,65	0,88
stdev indicator	112,854	117,883	1,044

Standard deviation is a dispersion indicator which shows the scattering of individual values around the average value of the sample. Formula used to determine indicator`s value is:

$$S = \sqrt{\frac{1}{N-1} \cdot \sum (D[n] - M_D)^2}$$

where n is (1, ...N-1, N),

M_D is average value of D data set and

S^2 is variance value.

The analysis revealed that the average size of cities in Romania decreased. This is because the number of towns grew faster than urban population (see Table 2) in the period under review. This is evident from the analysis of indicators average/town and stdev – standard deviation (see Table 4). *Average/town* indicator has a dynamic of 0.88, showing a decrease in urban population, while *standard deviation* had a dynamics of 1.044, showing an increase of urban population dispersion.

In Figure 1 it can be seen how the urban population has increased in the period under review for each of the defined towns groups.

Population growth is obvious especially in the first group, small towns, where the population almost doubled from 1978 to 2011.

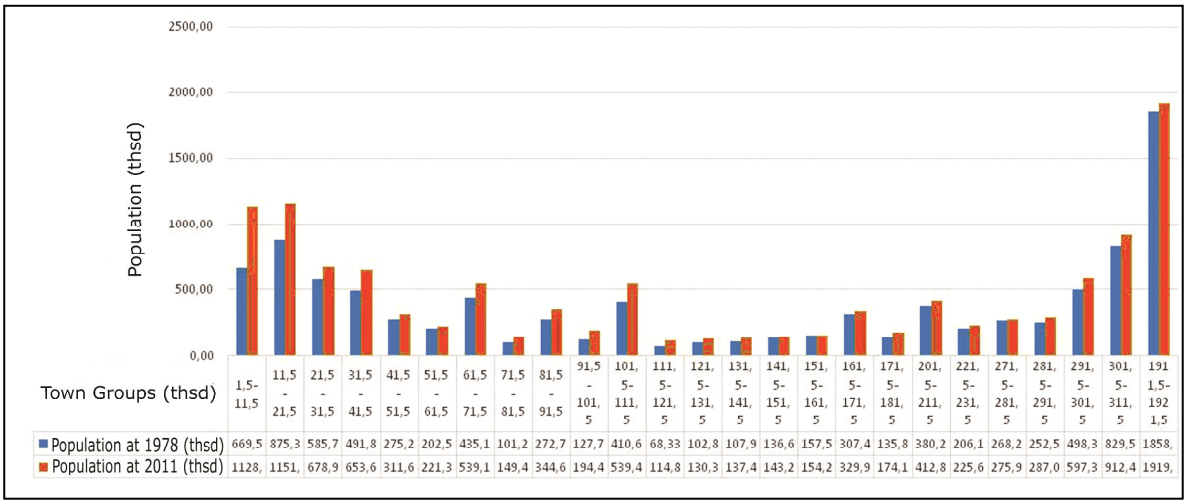
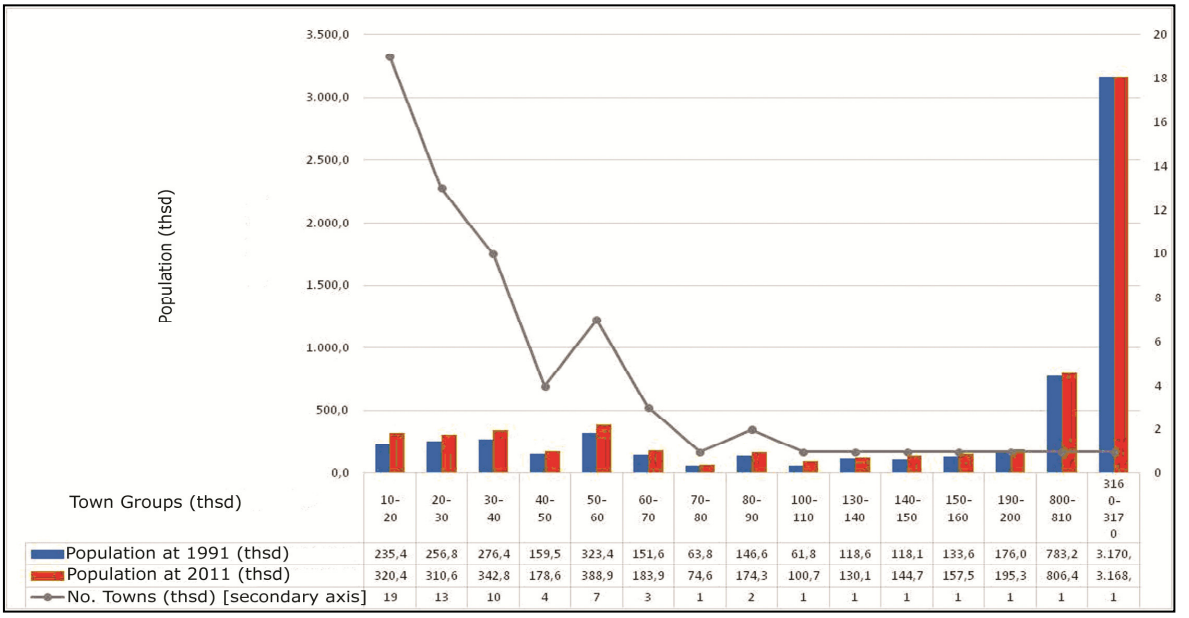


Fig. 1. Evolution of urban structure in Romania (1978 and 2011).

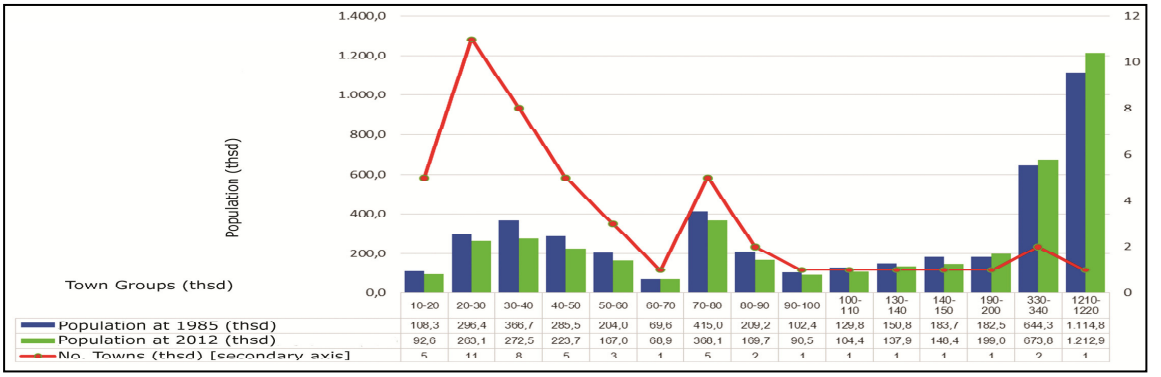
For comparison, the same graphic was made for two other European countries from the sample, Greece and Bulgaria. There were used the available data - that is for years 1991 and 2011 for Greece and 1985 and 2012 for Bulgaria.



Town Groups (thsd)	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	100-110	130-140	140-150	150-160	190-200	800-810	3160-3170
Population at 1991 (thsd)	235,4	256,8	276,4	159,5	323,4	151,6	63,8	146,6	61,8	118,6	118,1	133,6	176,0	783,2	3.170,
Population at 2011 (thsd)	320,4	310,6	342,8	178,6	388,9	183,9	74,6	174,3	100,7	130,1	144,7	157,5	195,3	806,4	3.168,
No. Towns (thsd) [secondary axis]	19	13	10	4	7	3	1	2	1	1	1	1	1	1	1

Fig. 2. Evolution of urban structure in Greece (1991 and 2011).

Evolution recorded - as shown in Figure 2 - is similar in Greece and Romania: number of inhabitants increased (steady but not significantly) in most categories of towns. The only category where the number of inhabitants has not changed is the one of large towns. Athens, the only town with a population of over three million inhabitants, had a linear trend, without increases or decreases in population (SGSNS Grecia). Bulgaria has a totally different pattern from that of Romania. Here, the categories of small and medium towns have significant population decreases in the analyzed period (see Figure 3).



Town Groups (thsd)	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-110	130-140	140-150	190-200	330-340	1210-1220
Population at 1985 (thsd)	108,3	296,4	366,7	285,5	204,0	69,6	415,0	209,2	102,4	129,8	150,8	183,7	182,5	644,3	1.114,8
Population at 2012 (thsd)	92,0	263,1	272,5	223,7	167,0	66,9	366,1	169,7	90,5	104,4	137,9	140,4	199,0	673,0	1.212,9
No. Towns (thsd) [secondary axis]	5	11	8	5	3	1	5	2	1	1	1	1	1	2	1

Fig. 3 Evolution of urban structure in Bulgaria (1985 and 2011).

An increase in population is noted only in the last three categories of towns, the largest (Sofia, Varna, Plovdiv). Sofia, capital of Bulgaria, recorded the largest increase in population from 1,114,000 inhabitants, in

1985 to 1,212,000 inhabitants, in 2012 (INS Bulgaria). This phenomenon may be assigned to population migration to large urban centers, especially in order to find better paid jobs.

Conclusions

Urban systems are characterized by high inertia, their development being carried out extremely slowly over very long periods of time. Structural changes are due to economic, social or political factors (CICADIT, 2014). In the present study we analyzed both monopolar urban structures - Greece and Hungary, focused around capital cities, Athens and Budapest - and multipolar urban structures - Romania, Bulgaria and Poland. In both cases, the degree of urban concentration fluctuated significantly.

The review observes existence of two categories of countries:

- countries where occurs concentration of urban structures - Bulgaria and Poland;
- countries where there is a deconcentrating process of urban structures - Greece, Hungary and Romania.

Only exception is Sweden, which maintains its urban structure almost perfectly constant - from 35.08% in 1990 to 35.33% in 2010. In Greece and Hungary there is a migration of population from large cities to smaller ones, less polluted and with an adequate infrastructure for their resident population. In Bulgaria and Poland population migration towards large urban centers can be attributed to opportunities to find better paid jobs. The average size of towns in Romania has decreased as the number of small towns grew faster (13.3%) than urban population (36.17% vs. 20.18%) over the analyzed period. Worth noting that we encountered difficulties in statistical homogeneity of statistical databases, sources being diverse and outdated.

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